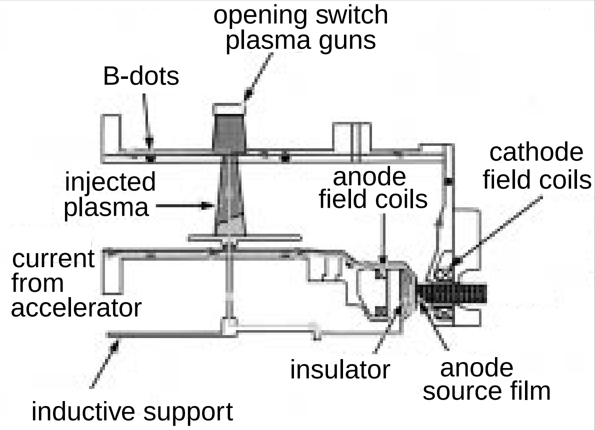
February 1994 Highlights of the Light Ion Inertial Confinement Fusion Program



EMFAAPS is an active anode plasma source driven by an external pulser.

We achieved our July 1994 goal to improve SABRE efficiency and reliability in order to support up to five shots per week. The useful shot rate increased from one per week to one per day. The one-sigma jitter of the new gas switches is < 2 ns, compared to > 5 ns before the August to October 1993 downtime for facility modifications. This is a major accomplishment: previously, erratic switch triggering dominated the irreproducibility of the power pulse, and 40% of the shots had an unacceptable power pulse. We conclude that the laser triggering upgrade recommended by the ICF Advisory Committee in April 1993 is unnecessary.

We are evaluating active cleaning methods on SABRE to improve ion source purity for possible use on PBFA II. RF glow discharge cleaning is best for removing impurities from anodes and cathodes on SABRE, which has a small A-K gap width compared to PBFA II, whereas DC discharge cleaning requires gas pressures too high for efficient impurity removal.

The exploding metal foil active anode plasma source, EMFAAPS (see figure), will be studied on Gamble II at NRL and on SABRE. This source can generate a dense, thin layer of protons via a short-pulse surface discharge breakdown. EMFAAPS uses an anode with metal film sputter deposited on an epoxy substrate. Previously, the epoxy was sanded and waxed prior to coating. A new casting method developed at NRL produces a glass-smooth surface that can be coated without additional preparation. Bench tests indicate that films deposited on the new epoxy are more uniform than with the former preparation method.

We are using the IPROP code developed by Mission Research Corporation to understand gas breakdown and beam propagation. IPROP is unique since it can follow fast electrons, which are important for non-local ionization events. The calculations agree well with Gamble-II net current measurements at NRL.

The stopping power of lithium ions can be calculated from the proton stopping power at the same velocity, multiplied by the square of the effective lithium charge. In designing targets, we need to know how this description changes when the target is also ionized. Calculations for nitrogen, zinc, and gold indicate the stopping power of foams and thin radiation cases is in reasonable agreement with measurements, but the calculated ranges of thick, ionized targets hit by low-energy (< 3 MeV) Li are a factor of two too high.

A draft of the Conceptual Design Report for the National Ignition Facility was submitted. A fourth first-wall workshop was held. In agreement with predictions, Nova experiments suggest no damage should occur to boron-sprayed aluminum panels of the first wall.

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Archived copies of the *Highlights* beginning July 1993 are available at http://www.sandia.gov/pulspowr/hedicf/highlights.